**From:** Blake Sanden [mailto:blsanden@ucdavis.edu]
**Sent:** Friday, February 24, 2012 2:56 PM
**To:** 'Robert Siegfried'; Jemaa, Fethi Ben
**Cc:** 'Laosheng Wu'; Avila, Andria K.
**Subject:** Sanden comments on Leaching Fraction/Requirement calcuations for Draft Methodology for Calculating Ag WUE

Bob and Fethi,

You got it basically right, except for one thing – the relationship (below and attached) assumes steady-state conditions so that your calculation of the LF (and thereby WUE or % deep percolation) is accurate for any point in time that you measure the ECi and the ECdw (or Cl concentration preferably to avoid some precipitation issues, and of course you are estimating ECdw by the soil ECe of the bottom of the rootzone soil sample).

In its simplest form, the leaching fraction (LF) or water percolating below the rootzone can be reduced to a simple mass balance of salt in, salt out:

$$\boxed{\frac{D_{dw}}{D_{iw}} = \frac{EC_{iw}}{EC_{dw}}}$$

Where:

$\mathbf{D_{dw}}$ = depth of drain water below rootzone

$\mathbf{D_{iw}}$ = depth of irrigation water

$\mathbf{EC_{iw}}$ = electroconductivity (or chloride concentration) of irrigation water

$\mathbf{EC_{dw}}$ = electroconductivity (or chloride concentration) of drain water

In reality, this mass balance is good for any irrigation, which is where the problem comes in – you could be 100% efficient with no LF during the season (this is true for many micro irrigated almonds) and then recharge with winter rain and do one 3 inch winter irrigation and get much more leaching with that small 6 to 7% of your total irrigation at that time than if you ran a 6% “assumed” LF for the whole season (much more would go to evaporation). Running this mass balance in this scenario might indicate an LF AT THAT TIME as much as 15 to 20%, which is not representative of the season.

I attached the salinity example I did in almonds and prepared for comments last October that has some more explanation. Also a paper by Sammis and his group where the accounted for the true Cl balance based on mass and not concentration – even Cl taken up by the plant.

I assume the problem is in defining LF for the Draft Methodology document going to the legislature as: LR= ECiw/ECdw
When in reality our salt tolerance thresholds are listed as “average rootzone” EC. I would take out the above equation and replace it with the Ayers and Westcott linearly averaged one reported in FAO 29. This is the closest thing we have to a worldwide standard:

$$LR = \frac{ECi}{5ECe - ECi}$$

Ayers, R.S., D.W. Westcot. Water Quality for Agriculture. FAO Irrigation and Drainage Paper 29 Rev. 1, Reprinted 1989, 1994 . http://www.fao.org/DOCREP/003/T0234E/T0234E00.htm (also Chapter 2 attached – see section starting page 14).

Originally in: Rhoades J.D. 1974. "Drainage for salinity control". Drainage for Agriculture. Van Schilfgaarde J. (ed). Amer. Soc. Agron. Monograph No. 17, pp 433–462.

The most accurate estimator of a real field LEACHING FRACTION is an end of season soil sample from the true bottom of the rootzone before any winter leaching has occurred to supply an estimate of the ECdw or (Chloride) and use the straight mass balance. For estimating a reasonable LEACHING REQUIRMENT based on irrigation water quality and crop salinity tolerance then the above Ayers and Westcott equation would be best.

Fethi, please record these as my final comments as an A-1 subcommittee member for the final DRAFT METHODOLOGY sent out 2/3/12.

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